Space Weather Technical Forecast

Issued on Wednesday, 27 July 2022 at 01:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight Chance of R1/R2 throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with an impulsive C8 flare observed at 26/1535 UTC and emanating from AR3060 which is now about to rotate off the northwest limb. Shortly after, a CME was seen heading west in Coronagraph imagery. The results of the analysis are not yet fully known however it is not considered to be Earth-directed. No Earth-directed CMEs were observed.

There are eight numbered sunspot regions on the visible disc, all of which are small and simple. They remain largely unchanged, with no evident growth or proliferation of spots observed, or are slowly decaying.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by DSCOVR and ACE at L1, slowly declined through the period, weakening from 450 to 360km/s, although a transient increase did occur between 26/0240-0750 UTC, allowing the solar wind speed to reach 530 km/s. Density was at or below average. The interplanetary magnetic field (IMF), Bt, was steady, at around 5-7nT, but the Bz changed from being negative and close to -5nT to positive and close to zero from 26/0230 UTC, then negative again after 26/0930 UTC and ranging from +6nT to -4nT. The Phi angle remained negative (towards the Sun). Geomagnetic activity was mostly Quiet, but had one Unsettled interval (Kp3) at 26/0000-0300 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES16 was at Background levels. The High energy electron flux (greater than 2MeV) varied between Normal Background and High levels, with a peak of 1230pfu observed at 26/1645UTC. Electron fluence displayed a slight decreasing trend while remaining below the Active threshold. An observed fluence of 4.14e7 integrated pfu was recorded at 27/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Activity is likely to remain Very Low to Low with only a slight chance of M-class flares despite the large number of sunspots on the Earth-facing disc, as these are currently all small and simple. There is the potential for far-side regions to rotate onto the disc by the middle of the period, and increasing this risk

Solar Wind / Geomagnetic Activity: No CMEs have been assessed as Earth-directed. Solar winds are expected to be mostly slow-ambient from day 1 to day 3, before becoming slightly elevated at the end of day 3 then elevated on day 4, under thee influence of the HSS originating from CH04/-. Geomagnetic activity is forecast to be mainly Quiet with a chance of Unsettled intervals, then to become Unsettled or Active with an outside chance of G1/Minor storms towards the end of day 3 (29th), but more likely on day 4 (30th).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is

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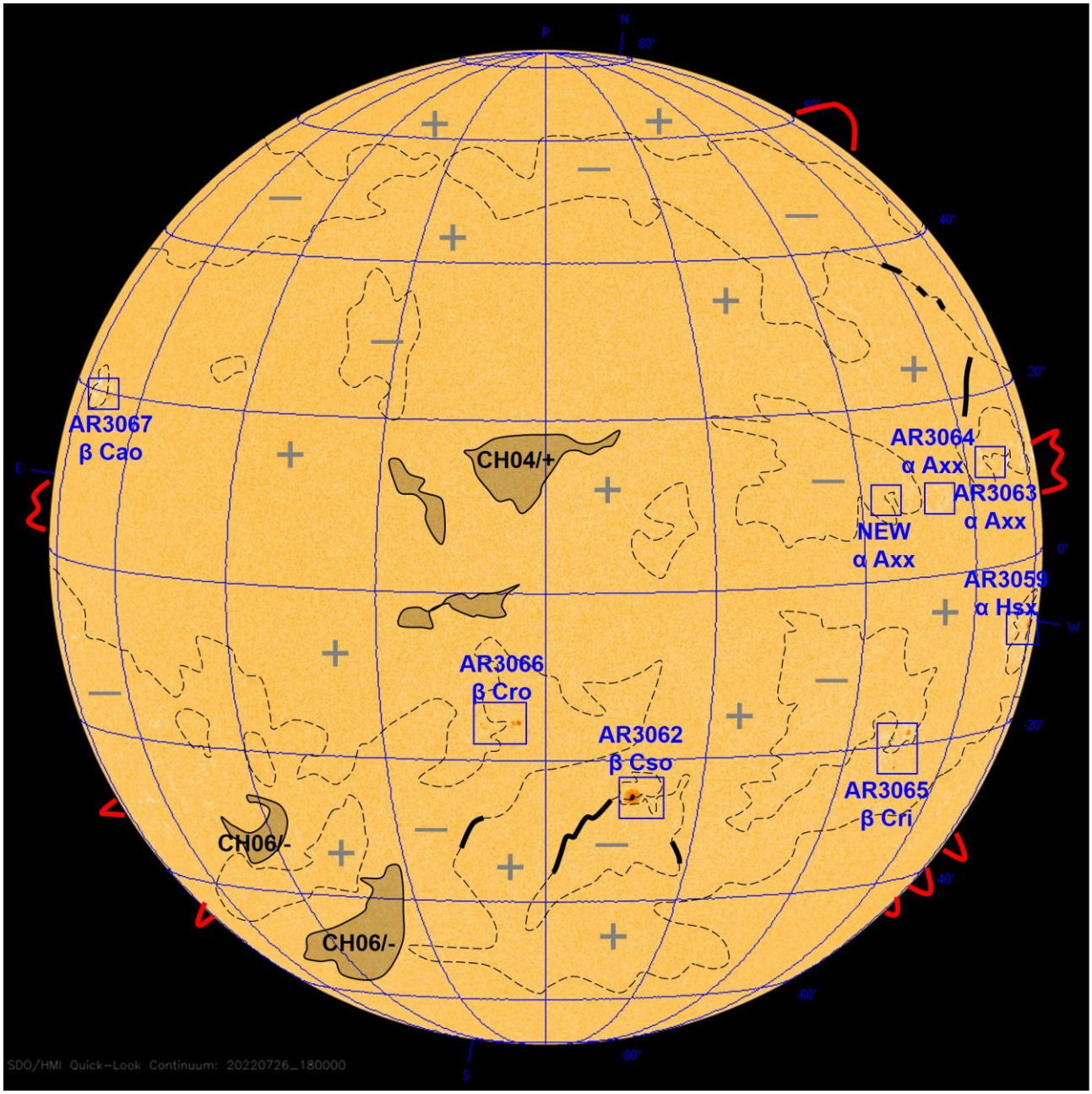
expected to remain at Background levels. The high energy electron flux (greater than 2 MeV) is expected to vary between Background and Moderate levels, with only a slight chance of increasing to High (greater than 1000 pfu) during the diurnal peak. Despite this, the 24 hour fluence is expected to remain below the Active threshold (1e8 integrated pfu).

Figure 1. Solar Analysis Valid 26/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs have been assessed as Earth-directed for this period.

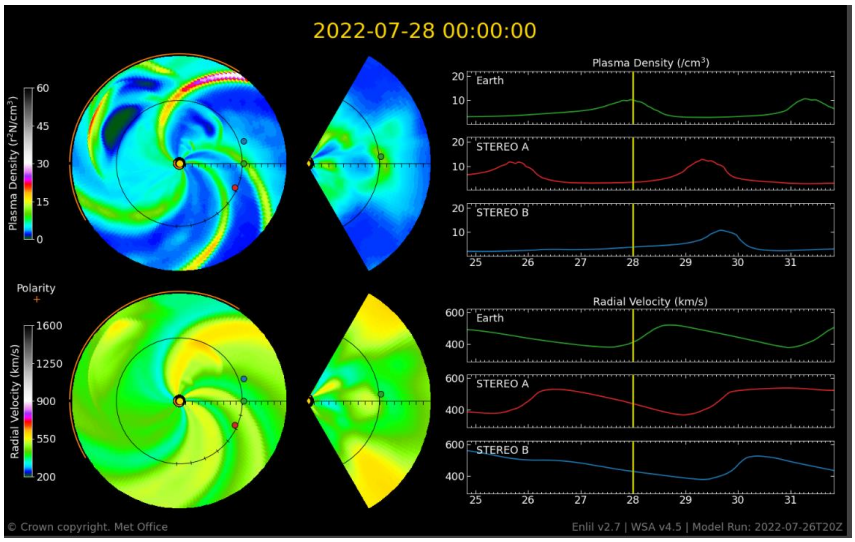
Solar wind speeds have been on the decline overall, down to 360km/s in the latter part of the 26th (UTC). However a slight increase has been observed around 26/2200 UTC, the solar wind speed reaching 410km/s accompanied by a slight increase of temperature. This could be due to the small unnumbered coronal hole that was visible a couple of days ago in the northwest disc. It was only small hence impacts should be minimal and only temporary, the solar wind soon returning to slow-ambient levels.

The next coronal hole worth of note is CH04, currently facing Earth. It is not a recurring feature so persistence cannot be relied upon, however based on its size and location, its associated high speed stream may arrive at the end of day 3 or (most likely) on day 4, with speeds estimated to be around 500-550km/s. Enlil suggests a notable enhancement on the 28th, however this is considered too soon. This is confirmed by Stereo A Mag & Plastic data which currently shows an absence of enhancement.

Geomagnetic activity is forecast to be mainly Quiet with a chance of Unsettled intervals, then to become Unsettled and Active with an outside chance of G1/Minor storms towards the end of day 3 (29th), but more likely on day 4 (30th).

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	1	10	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Enlil showing an enhancement on the 28th, currently not expected



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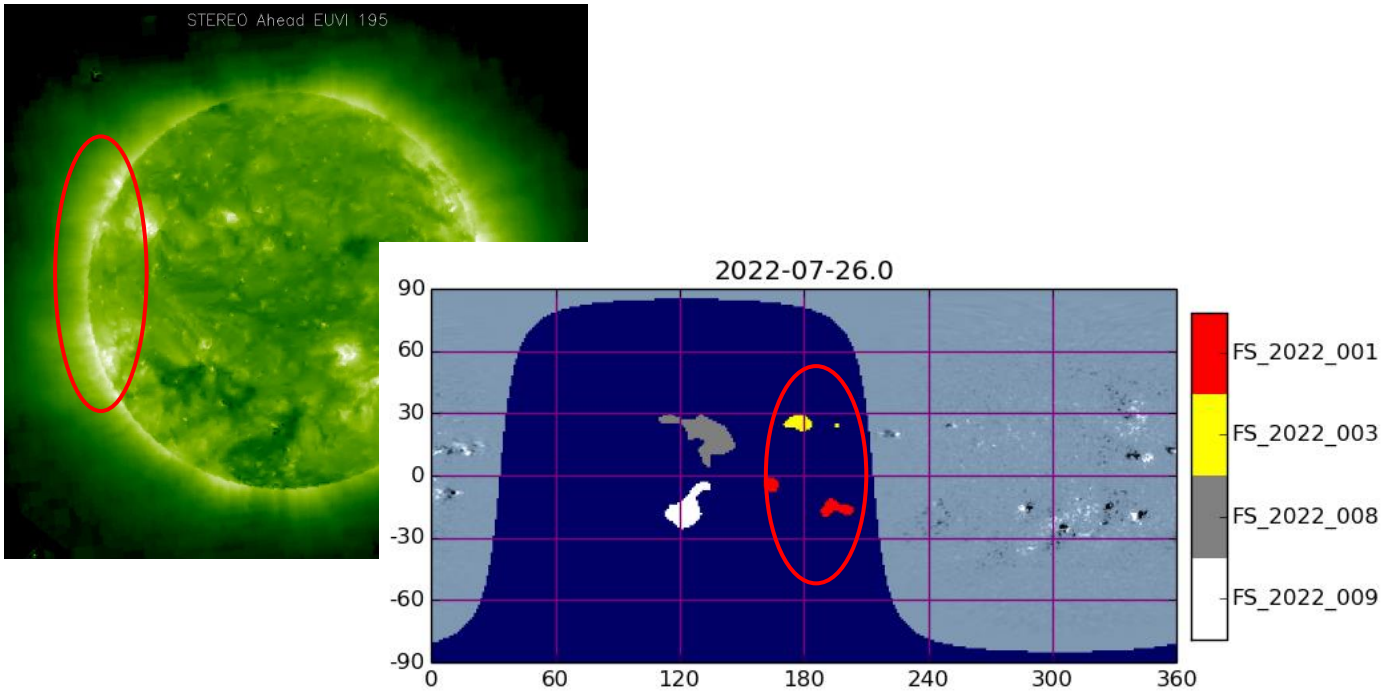
Radio Blackouts - X-Ray Flares:
Solar activity has been Low, with an impulsive C8 flare observed at 26/1535 UTC and emanating from AR3060 which is now about to rotate off the northwest limb. There are eight numbered sunspot regions on the visible disc, all of which are small and simple. They remain largely unchanged, with no evident growth or proliferation of spots observed, or are slowly decaying.

Activity is likely to remain Low or Very Low, with only a very Slight Chance of Moderate flares, mostly from AR3065. However, some bright flux regions are clearly visible on the western horizon in EUVI 195, indicating the presence of active regions on the far side. Some of these, at least two, are expected to rotate on the visible disc during this period, perhaps leading to an increased risk of fares.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: Latest EUVI 195 showing bright flux regions (left) and Stanford Seismic Monitor of the Sun's Far Hemisphere (right) which identifies "strong active regions"



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels and is currently expected to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES-16 has exhibited a declining trend despite recent solar wind enhancements. There is still the potential for flux levels to rise a little from day 1 to day 3 but with coronal hole 04 now facing Earth, there is an increasing chance for the associated high speed stream to arrive on day 4, which would lead to a drop in electron flux. Consequently, electron flux levels are expected to continue fluctuating between Background to Moderate from day 1 to day 3, perhaps reaching High during the diurnal cycle. Beyond that, a more persistent return to Moderate or Background levels appears more probable.

The corresponding 24-hour fluence is expected to remain below the Active threshold through the period, while perhaps displaying a slight rising trend over the next few days This is somewhat supported by the latest REFM output, with current levels of fluence very close to the forecast. The trend is however different, indicating a gradual decrease.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	10	10	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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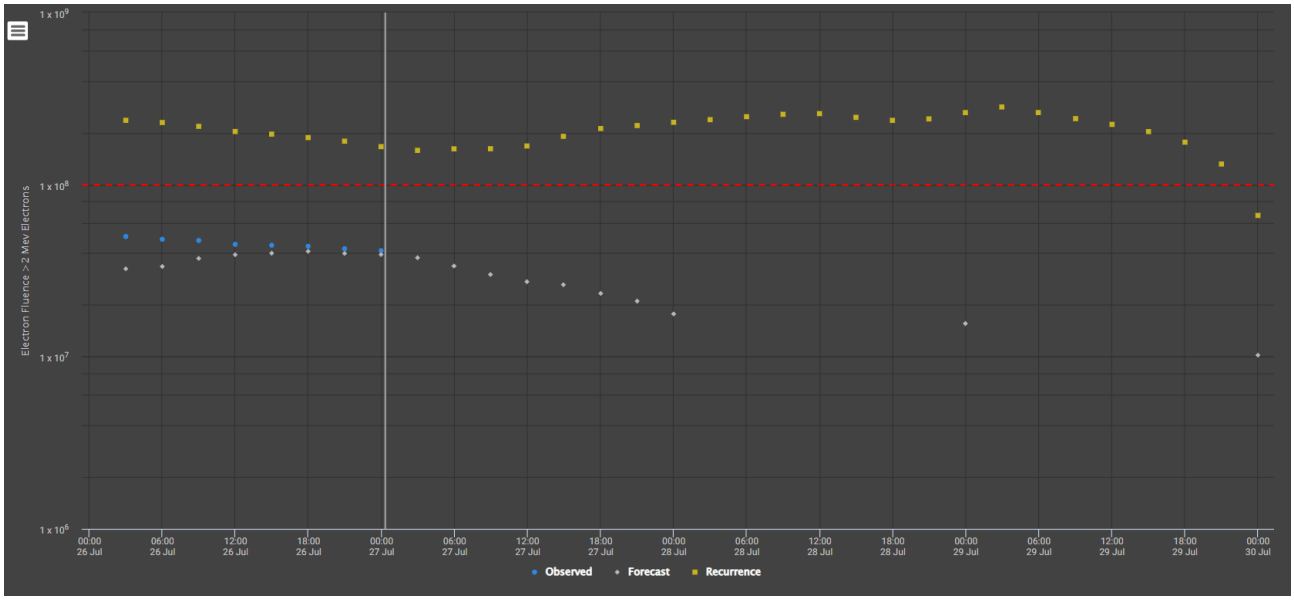
Figure 5: Latest REFM output, considered to give reasonable guidance



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